

SECTION 02510

ASPHALT CONCRETE PAVEMENT

PART 1: GENERAL

1.1 DESCRIPTION:

- A. This Work is the production and placement of plant mix asphalt concrete pavement.
- B. Hot plant mix asphalt concrete is a mineral aggregate and asphalt material mixed at a central hot plant meeting these specifications and placed in one or more courses on a newly prepared or existing street roadway in accordance with the contract documents.

1.2 REFERENCES:

AASHTO T11 (ASTM D1140)	Amount of Material Finer than No. 200 (0.075 mm) Sieve in Aggregate
ASTM D5361	Standard Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing
AASHTO T27 (ASTM C136)	Sieve Analysis of Fine and Coarse Aggregate
AASHTO T89 (ASTM D4318)	Determining Liquid Limit of Soils
AASHTO T90 (ASTM D4318)	Determining the Plastic Limit and Plasticity Index of Soils
AASHTO T283 (ASTM D4867)	Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
AASHTO T176 (ASTM D2419)	Sand Equivalent Value of Soils and Fine Aggregate
AASHTO T245 (ASTM D6926, D6927)	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
AASHTO T96 (ASTM C131)	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D2041	Theoretical Maximum Specific Gravity and Density of Bituminous Mixtures
ASTM C1097	Hydrated Lime for Use in Asphaltic Concrete Mixtures
ASTM D3666	Evaluating and Qualifying Agencies Testing and Inspecting
ASTM D5821	Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM C123	Lightweight Particles in Aggregate
ASTM D6307	Asphalt Content of Hot Mix Asphalt by Ignition Method
STM C142	Clay Lumps and Friable Particles in Aggregates
MS-2	Asphalt Institute – Mix Design Methods

PART 2: PRODUCTS

2.1 GENERAL:

- A. The Asphalt Concrete Surface Course must have at least a 3-bin separation, when continuous flow mixing types of plants are used. When a drum dryer is used with a weight batching system from dry bins, separate and stockpile the crushed aggregate into two sizes.
- B. The specific type and grading of aggregate shall be as indicated on the plans or in the contract documents. The types and grades are described in this specification.
- C. The furnishing of asphalt materials for use in asphaltic concrete mixes shall meet the requirements for the particular grade specified in the contract documents. The types and grades are described in this specification.
- D. Prepare pavement course to conform to the lines, grades, thickness and typical cross sections shown in project documents and plans, and shall be rolled, finished, and approved by the Engineer before the placement of the next course.

2.2 PLANT MIX AGGREGATES

- A. Furnish aggregates from acceptable sources approved by the Engineer.
- B. Furnish test data as outlined in this section on each source to be used for acceptance by the Engineer.
- C. Designation of the source of supply and the acceptability of the material there from, does not extend to the grading of the material as it may naturally come from the pit or crusher. Adjust the crusher and screens to remove certain portions of the material as may be necessary to furnish gravel that will comply with the specifications in the contract. No additional compensation will be allowed for such adjustment of the equipment or the rejection of waste. It is understood that the Engineer may order procurement of material from any portion of any area designated as a pit site and may reject portions of the deposit as unacceptable.
- D. Aggregate materials shall not contain more than 1.5% by weight of clay lumps, shale, or coal, nor shall light weight particles exceed 3.5% by weight. No combination of clay, shale, coal, or lightweight particles shall exceed 3.5% by weight. Do not use Scoria (fired clay). Aggregate materials shall conform to the grading stipulated in the contract documents. Use reasonable care in the selection of material in a pit so that uniform product will be produced at all times. No compensation will be allowed for such stripping of the pit as may be required in order that satisfactory material may be secured.

- E. Aggregate used shall consist of gravel, crushed to the specified size, crushed stone, composed of hard durable pebbles or stone fragments, reclaimed asphalt pavement, and finely crushed stone filler, sand or natural clean material, or other fine mineral material. The portion of the material retained on the No. 4 sieve (4.74 mm) will be called coarse aggregate and that passing the No. 4 sieve (4.74 mm) and retained on the #200 sieve (0.075 mm) will be called fine aggregate. The material passing the #200 (0.075 mm) will be called mineral filler. The reclaimed asphalt pavement shall be removed from its original location and reduced by suitable means to such particle size as may be required for use in hot plant mix asphalt concrete.
- F. For all gradings of fine aggregate, including any blended fine aggregate and mineral filler, passing a No 40 sieve (0.425 mm), shall have a liquid limit not exceeding 25 and a plasticity index of not more than 6.
- G. Produce coarse aggregate retained on the No. 4 sieve (4.75 mm) having a minimum of 50% by weight of particles with at least one mechanically fractured face. The coarse aggregate shall not exceed 40% wear at 500 revolutions.
- H. Preliminary acceptance of aggregates proposed for use may be made at the point of production. Final acceptance will be made only after tests of the aggregates are complete and in place.
- I. Surface Course Asphalt Plant Mix Aggregate:

TABLE 1

REQUIREMENTS FOR GRADING OF SURFACE COURSE AGGREGATE

Percentage by Weight Passing Job Mix Target Bands						
Sieve Size	Type A	Type B		Type C		Job Mix Tolerances
1" (25.0 mm)	100	---		---		---
¾" (19.0 mm)	91-93	100		---		+/- 7
½" (12.5 mm)	76-89	83-93		100		+/- 7
3/8" (9.5 mm)	61-79	73-87		91-93		+/- 7
No 4 (4.75 mm)	41-54	47-63		51-71		+/- 6
No 10 (2.00 mm)	31-39	32-43		34-46		+/- 6
No 40 (0.425 mm)	16-27	15-25		16-26		+/- 5
No 200 (0.075 mm)	4-7	5-7		5-9		+/- 2

1. The above gradation bands represent the job mix target limits, which determine the suitability of aggregate for use. The final job mix target

gradation must be within the specified bands and uniformly graded from coarse to fine and not vary from the low limits on one screen to the high limits on the adjacent screen, or vice versa. The final job mix gradation limits are established by applying the job mix tolerances to the job mix targets.

2. The job mix formula establishes target values. During production of the mix, the gradations shall lie within the job mix gradation limits specified in Table 1. For example, "Type A, No. 200" band is "4-7". QA job mix target of 5 has been selected for the final mix. The job mix gradation limits is 5, plus and minus 2. Therefore, the job mix gradation limits for production is 3-7.

2.3 ASPHALT BINDER MATERIAL

- A. Furnish Asphalt binder material to be used as specified in the contract documents that meet the type and grade specified requirements in this section in Table 3.
 - I. Grades:
 - a. (PGAB) PG 58-22
 - b. (PGAB) PG 58-28
 - c. (PGAB) PG 64-22
 - d. (PGAB) PG 64-28 (Polymer Modified)
- B. The percentage of asphalt by weight, to be added to the aggregate will be, generally, between 4 and 8 percent of the weight of the total mix. The mix design will establish the exact percentage of asphalt in the mix, based upon preliminary laboratory tests, sieve analysis and grading and character of the aggregate furnished within the specification limits. No claim is allowed for the payment for rejecting any batch or load of mixture containing an excess or deficient amount of asphalt binder varying more than 0.4 of a percent from the fixed mix design percentage.
- C. Obtain Engineer approval of the asphalt material source before shipments are made to any project. The source of supply cannot change after work is started unless approved in writing by the Engineer. The Engineer is not liable for the quantity shipped.
- D. Samples of asphalt binder material may be taken, as directed by the Engineer, and placed in uncontaminated one-quart containers. When sampled, these shall be taken from the tanker car or truck at the point of delivery on the project and submitted to the Engineer.
- E. All transport vehicles must be equipped with a spigot or gate valve installed in either: (1) the unloading line, (2) in the tanker at the centerline on the tank, (3) in

the pressure line from the unloading pump, or other locations approved by the Engineer. Assure the spigot or gate valve has a diameter of between 3/8 inch (1 cm) and 3/4 inch (2.5 cm). The spigot valve must be located to prevent contamination from plant dust or other contaminants.

- F. The supplier furnishing the asphalt binder material shall inspect each tanker car or truck before it is loaded and ship only in clean, uncontaminated, fully insulated cars or trucks, sealed after loading by the supplier.
- G. The material supplier shall issue, in duplicate, a certificate showing full compliance with the specifications for the designated grade of material, together with the following information. Project number, date of shipment, source of the material, car or truck initial and number, destination, gross quantity loaded, loading temperature, and net quantity in gallons at 60° F (15.5° C) or tons, whichever unit of measurement is stipulated. Assure the certificate of compliance accompanies the shipment and is furnished to the Engineer. The certificate, signed by the supplier representative, must also certify that the conveyance vessel was inspected and found to be free of contaminating material.
- H. The certificate of compliance is the basis for tentative acceptance and use of the material. Samples taken according to applicable sampling methods and retained by the Engineer may be tested at the Engineer's discretion. Failure of the asphalt material to meet these specifications may result in rejection of the entire, associated work. If rejected, removed and replace rejected work.
- I. Apply asphalt material at temperatures that assure uniform mixing or spreading. Application temperature ranges for each grade of material should be accompanied with the mix design. Application temperature for mixing applications will be in accordance with the mix design.
- J. Upon request by the Engineer, furnish the Engineer and/or laboratory (responsible for completing the mix design) with data or a report showing the temperature-viscosity relationship of each asphalt binder used on the project. Assure this data covers the range of temperatures used for mixing and compaction. In addition, the Engineer may request a complete set of test results from Table 3 for each grade used on the project.

TABLE 3
PERFORMANCE GRADED ASPHALT BINDER (PGAB)

Performance Grade	PG 58		PG 64		Test Methods
	-22	-28	-22	-28	
Average 7-day Maximum Pavement Design Temperature, °C	<58		<64		
Minimum Pavement Design Temperature, °C	>-22	>-28	>-22	>-28	
Original Binder					
Flash Point Temp.: Minimum °C	230				AASHTO T48
Viscosity: Maximum, 3 Pa · s (3000 CP), Test Temp, °C	135				ASTM D4402
Dynamic Shear: G* / sin delta, Minimum, 1.00 kPa Test Temp @ 10 rad / s, °C	58		64		AASHTO TP5
Rolling Thin Film Oven (AASHTO T240) or Thin Film Oven (T179) Residue					
Mass Loss, Maximum, %	1.0				AASHTO T240
Dynamic Shear: G* / sin delta, Minimum, 2.20 kPa Test Temp @ 10 rad / s, °C	58		64		AASHTO TP5
Pressure Aging Vessel Residue (AASHTO PP1)					
PAV Aging Temp, °C	100		100		AASHTO PP1
Dynamic Shear: G* / sin delta, Maximum, 5000 kPa Test Temp @ 10 rad / s, °C	22	19	25	22	AASHTO TP5
Creep Stiffness ^a : S, Minimum, 300 MPa m-value, Minimum, 0.300 Test Temp, @ 60 sec, °C	-12	-18	-12	-18	AASHTO TP1
Direct Tension ^a : Failure Strain, Minimum, 1.0%, Test Temp @ 1.0 mm/min. °C	-12	-18	-12	-18	AASHTO TP3

- a. If creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness is between 300 and 600 MPa the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

2.4 HYDRATED LIME FOR ASPHALT CONCRETE.

- A. Mineral filler may be incorporated in the asphalt concrete mixture. Furnish hydrated lime as filler when specified. Assure it is free of lumps and extraneous material and meets the following gradation requirements as per ASTM D242:

<u>Sieve</u>	<u>Percent Passing</u>
No. 30 (0.60 mm) Sieve	100
No. 80 (0.180 mm) Sieve	95-100
No. 200 (0.075 mm) Sieve	70-100

- B. Assure the hydrated lime meets paragraph 2 (chemical composition) and paragraph 7 (a) requirements (chemical analysis) of ASTM C1097.
- C. Where required, the mineral filler will be effectively mixed with the hot plant mix asphaltic concrete.

2.5 COMPOSITION OF MIXES:

A. General

1. Submit to the Engineer for approval a mix design for each mix required on the project. Assure the job-mix formula is within the gradation limits in Part 2 Products in this Section.
2. Have the job-mix formula prepared by an independent testing laboratory approved by the Engineer. The requirements of ASTM D-3666 are the guidelines for testing laboratory approval. The cost of the job-mix formula(s) is at Contractor expense.
3. Keep the job mix formula current and contain the following minimum information:
 - a. Gradation of all constituent aggregates.
 - b. Specific gravity of constituent aggregates and asphalt cement.
 - c. Source of supply of all materials and grade of Asphalt Cement.
 - d. Marshall design curves for stability, unit weight, flow and volumetric requirements (VMA and total voids) at asphalt contents below and above optimum (four points minimum).
 - e. Measured voidless (Rice's) specific gravity used in voids computations.
 - f. Composite aggregate grading.
 - g. Recommended asphalt cement content.
 - h. Marshall compactive effort (50 blows).
 - i. Date of mix design (job mix formula).
 - j. Index of retained strength.

4. In addition to the job mix formula, all asphalt concrete surfacing mix submittals will have laboratory tests indicating that the Tensile Strength Ratio (TSR) as determined by AASHTO T-283,, is at least 70%. Test shall be performed at 7.0 +/- 1% air voids and shall include the freeze cycle.

B. Asphalt Concrete Surface Course

1. The maximum permissible variation from the job-mix formula within the specification limits is as follows:
 - a. Aggregate Gradation Within Job Mix Tolerances
 - b. Asphalt ± 0.4 percent*
 - c. Temperature of Mix $\pm 20^{\circ} \text{F}$.

* This tolerance will be permitted only if the job mix parameter curves indicate that the corresponding Marshall design limits are not exceeded.
2. Produce Hot Plant Mix Asphalt Concrete Surface courses having the following characteristics as measured by AASHTO T245, ASTM D6726 & D6927 "Resistance to Plastic Flow of Bituminous Mixtures by Means of the Marshall Apparatus":
 - a. Number of compaction blows, each end of specimen 50.
 - b. Stability, minimum 1200.
 - c. Flow 8 – 18.
 - d. Air voids, percent 3-5.
 - e. Percent voids in mineral aggregate (minimum). See Table 4.

TABLE 4		
REQUIRED VOIDS IN MINERAL AGGREGATE (VMA)		
Nominal particle size (table 2)		Voids in Mineral Aggregate, Min.
3/8 – inch	(9.5 mm)	14
1/2 – inch	(12.5 mm)	13
3/4 – inch	(19.0 mm)	12
1 – inch	(25.0 mm)	11
1 1/2 – inch	(37.5 mm)	10
Nominal maximum particle size is one size larger than the first sieve to retain more than 10 percent.		

PART 3: EXECUTION

3.1 CRUSHING:

A. Crushing Equipment

1. Fit crushing plant-screening equipment, when required, with blowers or other devices capable of removing excess and undesirable fines.

B. Screening Plants

1. Screening plants consist of a revolving trommel screen, shaker screen, vibrating screen, or other devices capable of removing oversize material, excess and undesirable fines.

C. Scales

1. Furnish scales, when required, satisfactory to the Engineer. Test and certify scales prior to their use on the project and as often thereafter as the Engineer may consider necessary to insure their accuracy. Have on hand not less than ten, 50-pound weights for testing scales.
2. House the recording devices of the scales in a suitable manner. Place the scales in a location suitable to facilitate accurate weighing of loads. The scales shall be accurate to one-half of one percent at any weight. Alternate methods or devices for weighing may be acceptable, provided that these methods or devices produce the same degree of accuracy as required of platform scales.

3.2 MATERIAL HANDLING:

- A. All work involved in clearing and stripping pits and quarries, including handling unsuitable material encountered, are performed with no additional compensation being allowed for this work. The pits as utilized shall immediately be opened so as to expose the vertical faces of the various strata of acceptable material and, unless otherwise directed, the material shall be secured in successive vertical cuts extending through all the exposed strata.
- B. Provide, unless otherwise specified, material containing as large a proportion as possible of crushed aggregate. Combine the crushed material with the screened material to obtain a uniform product.
- C. No material will be accepted which is loaded into hauling units in a segregated condition or which does not meet the required grading. In case the material deposit contains sand or other material in excess of the specification gradation requirements, or of an unacceptable quality, such excess or undesirable material

shall be removed and disposed of prior to crushing, or during screening operations, if crushing is not required.

- D. Provide a storage bin of ample capacity to insure uniform quality and delivery of material. Loading of trucks directly from the conveyor belt, from the crusher or screening plant will not be permitted.

3.3 STOCKPILES:

- A. Grub and clean sites for aggregate stockpiles prior to storing aggregates. Assure the site is firm, smooth and well drained. Maintain a bed of aggregate suitable to avoid the inclusion of soil or foreign material.
- B. Build up coarse aggregate stockpiles in tiers of not more than 4 feet (1.2 m) in thickness. Assure each tier is completely in place before the next tier is placed. Do not allow material to "cone" down over the next lower tier.
- C. Dumping, casting or pushing over the sides of stockpiles will be prohibited, except in the case of fine aggregate stockpiles.
- D. Space stockpiles of different gradations of aggregate far enough apart, or separated by suitable walls or partitions, to prevent the mixing of the aggregates.
- E. Any method of stockpiling aggregate, which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate, will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has operated and failure of such samples to meet all grading requirements for the aggregate discontinuance of such stockpiling procedures.
- F. Transfer the aggregate from the stockpiles in such a manner that uniform grading of the material is preserved.

3.4 CONVEYOR STOCKPILING:

- A. Materials stockpiled by conveyors shall be deposited in a succession of merging-cone piles. Do not drop material over 12 feet (3.66 m) nor allow cones to exceed 12 feet (3.66 m) in height. Cones should be leveled to a thickness of approximately 4 feet (1.2 m) prior to starting another tier.

3.5 TRUCK STOCKPILING:

- A. Materials stockpiled by trucks shall construct the stockpile in tiers approximately 4 feet (1.2 m) in thickness. Complete each tier before the next tier is started.

3.6 ASPHALT MIXING PLANTS:

- A. Use mixing plants of either the weight batching type, the continuous flow mixing type, or drum dryer type. Use drum dryer mixers specifically designed and constructed for producing hot mix.
- B. Equip all plants with approved conveyors, power units, aggregate handling equipment, aggregate screens and bins that are coordinated and operated to produce a uniform mixture within the specified job mix tolerances.
- C. Use batch-type plants having a minimum batch production capacity of 2,000 pounds (900 kg). Use continuous flow or drum dryer plants having a minimum production capacity of 60 tons per hour (27 kg per hour). These capacity requirements may be modified if specified in the Contract Documents.
- D. Stop production and remove from the project mixing plants that fail to continuously produce a mixture meeting requirements as specified.

3.7 INSPECTION AND CONTROL OF ASPHALT MIXING PLANT:

- A. For verification of weights and measures, character of materials and determination of temperatures used in the preparation of the paving mixes, the Engineer or his authorized representative will, at all times, have access to all portions of the mixing plant, aggregate plant, storage yards and other facilities for producing and processing the materials for the work. All sampling and testing of processed and unprocessed material is performed in accordance with the provisions of the Contract Documents.

3.8 MIX DESIGN:

- A. The Owner's acceptance testing agency will make gradation analyses of the completed mix to assure that the materials being produced and used are within the tolerances of the mix design and the specifications of the mix being used.

3.9 SAMPLING AND TESTING FOR ACCEPTANCE:

- A. Sampling and testing of aggregates or other constituent materials will be performed by the Owner's testing agency at a frequency determined by the owner or the owner's representative. Marshall field control is performed under AASHTO T245, ASTM D6926 & D6927. Field density testing is by core testing for acceptance purposes. Densities to conform to Section 2510, 3.28. Gradations to be within the job mix gradation limits. Oil content to be within 0.4 percent of the Marshall Mix Design.

- B. Samples will be used to verify compliance with the requirements set forth in this Section. If there is a dispute, a third party testing firm may be retained by the contractor for additional retesting.

3.10 WEATHER LIMITATIONS:

- A. When the moisture in the stockpiled aggregate or the dryer adversely effects the quality of mix production, normal plant operations, or when pools of water are observed on the base, mixing and placing of hot-mix asphalt is prohibited.
- B. Do not place asphalt hot-mix surface course mixture when the air temperature is less than 40° F (4° C) and rising. Do not place asphalt hot-mix base course mixtures of compacted lifts 4 inches (10 cm) or more when the air temperature is less than 30° F (-1° C) and rising. Do not place asphalt upon a surface which is frozen or that has a temperature of less than 32° F (0° C). Do not place paving during rainfall or in standing water.

3.11 SURFACE PREPARATION:

- A. Assure the area to be paved is true to line and grade and has a dry and properly prepared surface before starting paving operations. Assure the surface is free from all loose screenings and other loose or foreign material.

3.12 NEW WORK:

- A. For new work, meet the surface preparation requirements in Sections 02230, 02234 or 02235 of these specifications. Prime prepared soil or aggregate bases if indicated as a bid item in the Contract Documents.
- B. Before paving, proof-roll the base with equipment having at least one 18 kip single axle load or equivalent. Excavate and replace areas that yield or crack under these wheel loads as directed. This does not replace or relax the base or subgrade compaction requirements.
- C. Paint the surfaces of curbs and gutters, vertical faces of existing pavements and all structures in contact with asphalt mixes with a thin coating of asphaltic material to provide a water-tight joint.

3.13 OVERLAYS OVER EXISTING PAVEMENTS AND OLD BASE:

- A. Where a base is rough or uneven, place a leveling course using a paver or motor grader and compact before the placing of subsequent courses.
- B. When specified, place construction fabric to control reflective cracking, as detailed, meeting Section 02110.3.4 Pavement Overlay Applications.

- C. When a leveling course is not specified, patch or correct all depressions and other irregularities, subject to the Engineer's approval, before starting other paving operations. Remove all rich and unsuitable patches, excess crack or joint filler, and all surplus bitumen from the area to be paved. Do not blot excessive deposits of asphalt with sand or stone.
- D. Apply a tack coat when the surface to be paved is an existing portland cement concrete, brick or asphalt pavement. When a tack coat is required, use the asphalt material indicated, at the rate specified in Section 02502.
- E. Coat the surfaces of curbs and gutters, vertical faces of existing pavements and all structures in actual contact with asphalt mixes with a thin, complete coating of asphalt material to provide a water-tight joint.

3.14 PATCHING:

- A. Weather Limitations
 - 1. Follow procedures set out in section 3.10.
- B. Surface Preparations
 - 1. Assure the area to be paved is true to line and grade, is dry and properly prepared surface before starting paving operations. Clean the surface of all loose screenings and other loose or foreign material.
 - 2. Before paving, proof roll the base. Areas that yield excessively or crack under such wheel loads will be excavated and replaced, to correct yielding and cracking problems. This does not replace the base or subgrade compaction requirements. Cut the edge of existing pavements against which additional pavement is to be placed straight and vertical.
 - 3. Minimum standards for patching new or existing pavement include the following:
 - a. Neatly cut all asphalt edges using a asphalt saw.
 - b. Cut asphalt edges to form as regular a patch shape as practical and should, in general, approximate a rectangle.
 - c. Cut asphalt edges at least 30 cm (12 inches) wider than the trench width on each side of trench excavations; and, in general, be cut parallel to the street centerline for mainline construction and perpendicular to the street centerline for service lateral construction.
 - 4. Remove and replace asphalt surface widths of less than 3 feet (90 cm).

C. Compaction

1. Compact to a density equal to or greater than 92 percent of Maximum Theoretical Density (RICE) as determined by ASTM D2041.

3.15 TRANSPORTATION OF MIX:

- A. Transport the mix in vehicles cleaned of all foreign material which may affect the mix. The truck beds must be painted, or sprayed with a lime-water, soap or detergent solution at least once a day or as often as required. After this operation elevate the truck bed and thoroughly drain it, with no excess solution being permitted. Dispatch the vehicles so that all material delivered is placed in daylight, unless the Engineer approves artificial light. Deliver material to the paver at a uniform rate and in an amount well within the capacity of the paving and compacting equipment.

3.16 SPREADING AND FINISHING:

- A. Spread and finish meeting the following requirements
 1. The maximum lift thickness is 2 1/2 inches (6.5 cm) for surface courses and 5 inches (13 cm) for base courses.

3.17 MECHANICAL PAVERS:

- A. Spread and strike off the base and surface courses with a mechanical paving machine. Operate the paving machine so that material does not accumulate and remain along the sides of the receiving hopper.
- B. Do not use equipment, which leaves tracks or indented areas, which cannot be corrected in normal operation, produces flushing or other permanent blemishes, or fails to produce a satisfactory surface.
- C. Construct longitudinal joints and edges to true line markings. Establish lines for the paver to follow in placing individual lanes parallel to the centerline of the proposed roadway. Position and operate the paver to follow closely the established lines.
- D. When using pavers in echelon, assure the first paver follows the marks or lines with the second paver following the edge of the material placed by the first paver. To assure a hot joint and obtain proper compaction, assure the pavers work as close together as possible not exceeding 100 feet (30 m) apart. In backing trucks against the paver, take care not to jar the paver out of its proper alignment.

- E. As soon as the first load of material has been spread, check the texture of the unrolled surface to determine its uniformity. Segregation of materials is not permitted. If segregation occurs, suspend spreading operation until the cause is determined and corrected.
- F. Offset transverse joints in succeeding courses at least 2 feet (0.6 m). Offset longitudinal joints at least 6 inches (15 cm).
- G. Correct all irregularities in alignment left by the paver by trimming directly behind the machine. Immediately after trimming, thoroughly compact the edges of the course by tamping. Avoid distorting the pavement during this operation.
- H. Assure edges against which additional pavement is to be placed is straight and approximately vertical. Use a lute or covered rake immediately behind the paver, when required, to obtain a true line and vertical edge. Correct all irregularities in the surface of the pavement course directly behind the paver. Remove excess material forming high spots by a shovel or lute. Fill low areas with hot mix and smooth it with the back of a shovel being pulled over the surface. Fanning of material over such areas is not permitted.

3.18 MOTOR GRADER:

- A. When motor graders are used for the spreading of leveling courses, place the material on the roadbed so that the proper amount of material is available. Spread the mix to the required thickness, line and grade, with a uniform surface texture, while at a workable temperature.

3.19 HAND SPREADING:

- A. In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Engineer. Wood or steel forms, approved by the Engineer, rigidly supported to assure correct grade and cross section, may be used. In such instances, measuring blocks and intermediate strips must be used to obtain the required cross-section. Perform hand placing carefully. Uniformly distribute the material to avoid segregation of the coarse and fine aggregate. Broadcasting of material is not permitted. During the spreading operation, loosen and uniformly distribute all material using lutes or covered rakes. Reject material that has formed into lumps and does not break down readily. Following placing and before rolling, check the surface with templates and straightedges and correct all irregularities.
- B. Maintain on the project heating equipment for keeping hand tools free from asphalt. Exercise caution to prevent heating that may burn the material. Assure the temperature of the tools when used is not greater than the temperature of the mix being placed. Use heat only to clean hand tools; petroleum oils or solvents are not permitted.

3.20 COMPACTION:

- A. Furnish the number of rollers necessary to provide the specified pavement density. During rolling, keep the roller wheels moist to avoid picking up the material.
- B. After the longitudinal joints and edges have been compacted, start rolling longitudinally at the sides and progress toward the center of the pavement. For transverse graded streets, begin rolling on the low side and progress to the high side, overlapping passes by at least one-half the width of rollers and uniformly lapping each preceding pass. Operate the rollers at a slow, uniform speed with the drive roll or wheel nearest the paver. Do not exceed 3 miles per hours (4.8 km per hour).
- C. Do not quickly change the line of rolling reversing direction suddenly. If rolling displaces the material, re-work the area using lutes or shovels and restore it the original grade of the loose material before re-rolling. Do not permit heavy equipment or rollers to stand on the finished surface before it has been compacted and has thoroughly cooled.
- D. When paving in single width, roll the first lane placed as follows:
 - 1. Transverse joints
 - 2. Outside edge
 - 3. Initial or breakdown rolling, beginning on the low side and progressing toward the high side
 - 4. Second rolling, same procedure as 3
 - 5. Finish rolling
- E. When paving in echelon, or abutting a previously placed lane, perform the longitudinal joint rolling the same as transverse joint rolling.
- F. When paving in echelon, leave 2 or 3 inches (5 to 7.5 cm) of the edge unrolled, which the second paver can match unrolled. Then the joint between the lanes can be rolled together. Do not leave edges exposed more than 15 minutes without being rolled.
- G. In laying a surface mix adjacent to any finished area, place it high enough so that, when compacted, the finished surface is true and uniform.
- H. On slight grades, check gutters with a straightedge and test with running water to assure drainage to the planned outlet.

- I. The average density shall be equal to or greater than 93 percent of the maximum density as determined by ASTM D2041 and no individual sample shall be less than 92 percent of maximum density.

3.21 TRANSVERSE JOINTS:

- A. Construct and compact transverse joints to provide a smooth riding surface. Joints will be straight edged and string lined to assure smoothness and true alignment.
- B. Joint formed with bulkheads to provide a straight line and vertical face will be checked with a straightedge before fresh material is placed against it to complete the joint. If bulkheads are not used to form the joint and the roller is permitted to roll over the edge of the new material, locate the joint line in back of the rounded edge the distance required to provide a true surface and cross-section. If a joint has been distorted by traffic or by other causes, trim it to line. Paint the joint face with a thin coating of asphalt before the fresh material is placed against it.
- C. Place the material against the joints vertical face with the paving machine positioned so that the material overlaps the edge of the joint 1 to 2 inches (2.5 to 5 cm). Maintain a uniform depth of the overlapped material. Remove and dispose of the coarse aggregate in the overlapped material that dislodged during raking.
- D. Position rollers on the previously compacted material transversely so that no more than 6 inches (15 cm) of the rolling wheel rides on the edge of the joint. Operate the roller to pinch and press the mix into place at the transverse joint. Continue rolling along this line, shifting position gradually across the joint, in 6-to 8-inch (15 to 20 cm) increments, until the joint has been rolled by entire width of the roller wheel.
- E. Keep the number of transverse joints to a minimum. When paving single width and maintaining traffic, pave one lane no farther than one block. Complete all lanes to the same station at the end of each paving day. When paving in echelon, bring the lanes up even as is practical.

3.22 LONGITUDINAL JOINTS:

- A. Roll longitudinal joints directly behind the paving operation. Assure the first lane placed is true to line and grade and has a vertical face. Place the material in the lane being paved up firmly against the face of the previously placed lane. Position the paver during spreading to assure the material overlaps the edge of the lane previously placed by 1 inch to 2 inches (25 to 50 mm). Uniformly maintain the width and depth of the overlapped material at all times. Keep the paver aligned with the line or markings placed along the joint for alignment purposes. Before rolling, remove and dispose of the coarse aggregate in the material overlapping the joint.

- B. Shift rollers onto the previously placed lane so that not more than 6 inches (15 cm) of the roller wheel rides on the edge of the fine material left by brooming. Operate the rollers to compact the fines gradually across the joint. Continue rolling until a compacted, neat joint is obtained. When the abutting lane is not placed in the same day, paint the joint with a very thin coating of asphalt before placing the abutting lane. If the joint is distorted during the day's work by traffic or by other causes, carefully trim the edge of the lane to a neat line.

3.23 EDGES:

- A. Roll the pavement edges concurrently with or immediately after rolling the longitudinal joint.
- B. Exercise care in consolidating the course along the entire length of the edges. In rolling pavement edges, extend the roller wheels 2 to 4 inches (5 to 10 cm) beyond the pavement edge.

3.24 BREAKDOWN ROLLING:

- A. Immediately begin breakdown rolling following the rolling of the longitudinal joint and edges. Operate rollers as close to the paver as required to obtain density without causing undue displacement. Operate the breakdown roller with the drive roll or wheel nearest the finishing machine. The Engineer may make exceptions when working on steep slopes or super-elevated curves.

3.25 SECOND ROLLING:

- A. Assure the second rolling follows the breakdown rolling as close as possible while the paving mix is still at a temperature that will provide the specified density.

3.26 FINISH ROLLING:

- A. Perform the finish rolling while the material is still warm enough to remove roller marks. If necessary, the Engineer may require using pneumatic-tired rollers. Complete finish rolling the same day the mixture is placed.
- B. In places inaccessible to standard rollers, perform compaction using trench rollers or others to meet the specified compaction requirements. Operate the trench roller as directed until the course is compacted. Hand, manual or mechanical tamping, may be used in such areas if it is proved to the Engineer that the operation will provide the specified density.

3.27 SHOULDERS:

- A. Where paved shoulders or curbs are not specified, do not place the shoulder material against the pavement edges until the surface course rolling is completed.

Take care to prevent distortion of the pavement edge from specified line and grade. When shoulders are paved (except in conjunction with the traveled way paving), cold joint construction procedure is required to assure a tight bond at the joint.

- B. When the rolling of the surface course has been completed and the edges have been thoroughly compacted, immediately place shoulder material against the edges and roll it.

3.28 DENSITY AND SURFACE REQUIREMENTS:

- A. The average mat density shall be equal to or greater than 93 percent of the maximum density as determined by ASTM D2041 and no individual sample shall be less than 92 percent of maximum (Rice's) density, prepared as specified in Part 2-Products in this section and made from plant mix meeting the job-mix formula. Verification of maximum density as determined by ASTM D2041 from plant produced material during production is recommended.
- B. Produce a final surface that is uniform in texture and meets the line and grade specified. Before final acceptance of the Project or during the progress of the work, the Engineer will determine the thickness of all courses. Repair or replace all unsatisfactory work.
- C. Assure density and thickness meets the plans and specifications. During compaction, preliminary tests to aid in controlling the thickness, may be performed by inserting a flat blade, correctly graduated, through the material to the top of the previously placed base, or by other approved methods.
- D. In checking compacted depth, the cutting of the test holes, refilling with acceptable materials and proper compaction may be performed by the Owner's testing agency.
- E. For testing the surface on all courses, a 10-foot (3 m) straightedge will be used with the centerline of the straightedge placed parallel to the roadway centerline.
- F. Any variations that exceed 5/16-inch (0.8 cm) in 10 feet (3 m) for base course and 1/4-inch (0.64 cm) in 10 feet (3 m) for surface course must be corrected. Correct irregularities that may develop before the completion of rolling by loosening the surface mix and removing or adding materials as is required. If any irregularities or defects remain after the final compaction, remove the surface course and place and compact new material to a true and even surface. All minor surface projections, joints and minor honeycombed surfaces must be rolled smooth to grade, as directed.

- G. Remove and replace areas of new pavement requiring patching as directed. Patching material will be tested for meeting specifications. The cost of testing is at Contractor expense.

3.29 PAVEMENT AND MATERIAL TESTING REQUIREMENTS:

- A. Owner's testing agency will provide core samples of asphalt surface courses to check in place density and compacted depth. The cores are 4-inch (10 cm) diameter. Materials and acceptance tests will be made by the Owner's testing agency to determine the Contractor's compliance with the specifications.
- B. Materials failing to meet the tests specified may be retested if approved and as directed by the Engineer. The Contractor shall pay the costs of any required re-testing for acceptance purposes. Re-testing will be performed by the Owner's testing agency unless otherwise approved by the owner. . If there is a dispute, a third party testing firm may be retained by the contractor for additional retesting for the Engineer's review and consideration.
- C. The costs of the following tests are at Contractor expense:
 - 1. Initial aggregate quality tests
 - 2. Job-Mix Formula
 - 3. Any tests the Contractor requires to control his crushing, screening or other construction operations
 - 4. Retesting of failing tests as provided above
- D. Correct all pavement composition, field density, or thickness, deficiencies at Contractor expense.
- E. The field density and thickness of the pavement is determined by measuring the cores tested. The actual thickness must be no less than 1/4-inch (6.5 mm) from the specified thickness.
- F. When the measurement of any core is less than the plan thickness by more than the allowable deviation, the actual thickness of the pavement in this area may be determined by taking additional cores at intervals parallel to the centerline in each direction from the affected location. Continue in each direction until a core is found which is not deficient by more than the allowable deviation. The Engineer will evaluate areas found deficient in thickness and determine which areas warrant removal. Remove and replace the areas with asphaltic concrete of the thickness shown on the plans. Additional coring is considered as re-testing of failing areas.

PART 4: MEASUREMENT AND PAYMENT

4.1 TONNAGE BASIS:

A. Asphalt Concrete Pavement

1. These items are measured by the ton of 2,000 pounds (900 kg) of asphalt paving mixture, including the weight of the asphalt. The quantities measured for payment are the amount of asphalt paving materials actually used in the completed and accepted work in accordance with the plans and specifications.
2. "Asphalt Concrete Pavement" is paid for at the unit price bid per ton of 2,000 pounds (900 kg).
3. Price and payment is full compensation for cleaning base or underlying course; for producing, furnishing, transporting, stockpiling, heating, drying and screening of aggregate materials; for furnishing, handling, measuring, mixing, manipulating and placing of materials; for hauling, placing, shaping, compacting and finishing of the paving mix; for improving unsatisfactory areas; for furnishing samples; for furnishing, testing and certifying of scales; for furnishing the weigh house; for all materials (exclusive of asphalt), manipulation, labor, tools, equipment and incidentals necessary to complete the work in full compliance with the plans and specifications.
4. Payment is made under:
 - a. Asphalt Concrete Pavement Base Course - per ton (metric ton)
 - b. Asphalt Concrete Surface Course Grade "_____" - per ton (metric ton).

B. Asphalt Cement

1. This item is measured by the ton of 2,000 pounds (900 kg). The tonnage to be paid for is the number of tons of the asphalt cement materials used as ordered in the accepted work. Tonnage used in the paving mixture is computed from the truck weigh tickets by using the percentage of asphalt in the approved mix (and verified by extracted asphalt cement content by ASTM D6307). "Performance Graded Asphalt Cement", measured as provided above, will be paid for at the unit prices bid per ton.
2. Price and payment is full compensation for furnishing, handling, storing, heating, transporting and placing in the mixture; for all samples and for all labor, tools, equipment and incidentals necessary to complete the work in full compliance with the plans and specifications.

3. Payment is made under:

- a. PG 58-22 ASPHALT CEMENT – per ton (metric ton).
- b. PG 58-28 ASPHALT CEMENT – per ton (metric ton).
- c. PG 64-22 ASPHALT CEMENT – per ton (metric ton).
- d. PG 64-28 ASPHALT CEMENT – per ton (metric ton).

C. Hydrated Lime

- 1. This item is measured by the ton of 2,000 pounds (900 kg) for the amount of hydrated lime actually used in the completed and accepted work.
- 2. The quantities of “Mineral Filler”, measured as provided above, are paid for at the unit price bid per ton. Price and payment is full compensation for furnishing, storing, handling, and other charges, all tools, equipment, labor and performance of all work necessary to mix the material with the Asphalt Concrete and all other incidentals necessary to complete this item.
- 3. Payment is made under:
 - a. Mineral Filler - per ton (metric ton).

4.2 SQUARE YARD BASIS:

A. Asphalt Concrete Pavement

- 1. These items are measured by the square yard of asphalt pavement surface area. The quantities measured for payment are the square yards (square meters) of specified thickness of asphalt paving in the completed and accepted work as measured in the field. “_____” Thickness of Asphalt Concrete Pavement Base or Surface Course. Grade “_____” is paid for at the unit price bid per square yard (square meter).
- 2. Price and payment is full compensation for cleaning base or underlying course; for producing, furnishing, transporting, stockpiling, heating, drying and screening of aggregate materials; for furnishing, handling, measuring, mixing, manipulating and placing of materials; for hauling, placing, shaping, compacting and finishing of the paving mix; for improving unsatisfactory areas; for furnishing samples; for all materials (exclusive of asphalt and mineral filler), manipulation, labor, tools, equipment and incidentals necessary to complete the work in full compliance with the plans and specifications.
- 3. Payment is made under:

- a. "_____"Thickness of Asphalt Concrete Pavement - Base Course - per square yard (square meter).
- b. "_____"Thickness of Asphalt Concrete Pavement - Surface Course Grade"_____" - per square yard (square meter).

4. Asphalt Cement

- a. No separate measurement and payment is made for this item. The cost for this item is to be included in the cost for Asphalt Concrete Pavement Base and/or Surface Course.

5. Hydrated Lime

- a. This item is measured by the ton of 2,000 pounds (900 kg) for the amount of hydrated lime actually used in the completed and accepted work. The quantity of "Hydrated Lime", measured as provided above, is paid for at the unit price bid per ton.
- b. Price and payment is full compensation for furnishing, storing, handling and other charges, all tools, equipment, labor and performance of all work necessary to mix the material with the Asphalt Concrete and all other incidentals necessary to complete this item.
- c. Payment is made under:
 - 1) Hydrated Lime - per ton (metric ton).

4.3 LINEAR FOOT BASIS:

A. Asphalt Concrete Pavement Base and Surface Courses

- 1. These items are measured by the linear foot of asphalt pavement trench restoration. The quantities measured for payment are the linear feet of specified thickness of asphalt paving in the completed and accepted work as measured in the field along the trench centerline.
- 2. Price and payment is full compensation for cleaning base or underlying course; for producing, furnishing, transporting, stockpiling, heating, drying and screening of aggregate materials; for furnishing, handling, measuring, mixing, manipulating and placing of materials; for hauling, placing, shaping, compacting and finishing of the paving mix; for improving unsatisfactory areas; for furnishing samples; for all materials (exclusive of asphalt and mineral filler), manipulation, labor, tools, equipment and incidentals necessary to complete the work in full compliance with the plans and specifications.

3. Payment is made under:

- a. "_____"Thickness of Asphalt Concrete Pavement - Base Course - per lineal foot (lineal meter).
- b. "_____"Thickness of Asphalt Concrete Pavement - Surface Course Grade"_____" - per lineal foot (lineal meter).

4. Payment is made under:

- a. Asphalt Concrete Pavement Base Course - per linear foot (linear meter).
- b. Asphalt Concrete Pavement Surface Course Grade"_____" - per linear foot (linear meter).

B. Asphalt Cement

1. No separate measurement and payment is made for this item. The cost for this item is to be included in the cost for Asphalt Concrete Pavement Base and/or Surface Courses.

C. Hydrated Lime

1. This item is measured by the ton of 2,000 pounds (900 kg) for the amount of hydrated lime actually used in the completed and accepted work.
2. The quantity of "Mineral Filler", measured as provided above, is paid for at the unit price bid per ton. Price and payment is full compensation for furnishing, storing, handling and other charges, all tools, equipment, labor and performance of all work necessary to mix the material with the Asphalt Concrete and all other incidentals necessary to complete this item.
3. Payment is made under:
 - a. Mineral Filler - per ton (metric ton).

4.4 PATCHING:

- A. Patching is paid for at the contract unit price bid. Price and payment is full compensation for work and incidentals necessary to complete this item.

1. Payment is made by either of the following as identified under in the Contract documents:
2. Square Foot Basis
 - a. These items are measured by the square foot of asphalt pavement. The quantities measured for payment are the square feet of

specified thickness of asphalt paving in the completed and accepted work as measured in the field.

3. Tonnage Basis

- a. These items are measured by the ton of 2,000 pounds (900 kg) of asphalt paving mixture, including the weight of the asphalt cement. The quantities measured for payment are the amount of asphalt paving materials actually used in the completed and accepted work in accordance with the plans and specifications.
- b. Payment will not be made for correction of defective work as described in Section 3.29.

4. Price and payment is full compensation for cleaning base or underlying course; for producing, furnishing, transporting, stockpiling, heating, drying and screening of aggregate materials; for furnishing, handling, measuring, mixing, manipulating and placing of materials; for hauling, placing, shaping, compacting and finishing of the paving mix; for improving unsatisfactory areas; for furnishing samples; for all materials (exclusive of asphalt and mineral filler), manipulation, labor, tools, equipment and incidentals necessary to complete the work in full compliance with the plans and specifications.

5. Payment is made under:

- a. “_____” Thickness of Asphalt Concrete Pavement - Base Course - per ton (900 kg) or square foot (square meter).
- b. “_____” Thickness of Asphalt Concrete Pavement - Surface Course Grade “_____” - per ton (900 kg) or square foot (square meter).

END OF SECTION